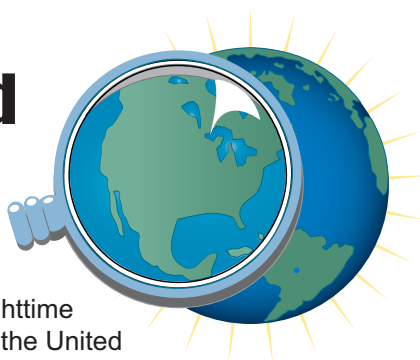




Where do we choose to live and why?



Investigation Overview

In this investigation, students use a nighttime image to observe areas of light across the United States and to identify patterns and spatial distributions of human settlements. They explain the reasons for these patterns by answering questions and making inferences about what they observe. Then this knowledge is applied to identify similar patterns and spatial distributions on an unidentified region of the world using a color topographic map and nighttime image.

Time required: One or two 45-minute sessions

Materials/Resources

Briefing and Logs 1, 2, and 3 (one copy for each student)
Figure 2: United States at night puzzle (one per student or student group)
Figure 5: United States relief map (one per student or student group)
U.S. road/travel map or atlas
World map or globe
Overhead transparency sheet
Overhead markers (light colors)
Clear cellophane tape
Scissors

Content Preview

The spatial concepts of pattern, dispersion, and density help to analyze geographic distributions. Maps and images of the United States and other areas of the world provide the information needed to describe and explain the spatial distribution of settlements.

Classroom Procedures

Beginning the Investigation

1. To begin the investigation, have students examine a U.S. road map and discuss the distribution of the population and human settlement features such as cities, highways, transportation hubs, and other areas. A classroom atlas can be used, or U.S. road maps can be purchased at most stores or local travel agencies.
2. Have students identify and list any patterns they see. Some pattern examples are large concentrations of settlements separated by what appears to be unoccupied space, lines of settlement near water, and settlements located with respect to landforms, such as at the foot of mountains.

Geography Standards

Standard 1: The World in Spatial Terms

How to use maps and other geographic representations, tools, and technologies to acquire, process, and report information from a spatial perspective

- Use geographic tools and technologies to pose and answer questions about spatial distributions and patterns on Earth.

Standard 3: The World in Spatial Terms

How to analyze the spatial organization of people, places, and environments on Earth's surface

- Analyze and explain distributions of physical and human phenomena with respect to spatial patterns, arrangements, and associations.

Geography Skills

Skill Set 4: Analyzing Geographic Information

- Interpret information obtained from maps, aerial photographs, satellite-produced images, and geographic information systems.
- Interpret and synthesize information obtained from a variety of sources—graphs, charts, tables, diagrams, texts, photographs, documents, and interviews.

Skill Set 5: Answering Geographic Questions

- Make generalizations and assess their validity.
- Develop and present combinations of geographic information to answer geographic questions.

3. Allow students to discuss the following questions:
 - Why are some areas empty and some areas more densely populated? (*Due to physical features such as water bodies, mountain ranges, or deserts.*)
 - How are these areas connected to each other? (*Via roads, rails, or air transportation.*)
 - Where do most of the larger cities seem to be located? (*In the eastern part of the country and along coasts.*) Why? (*Historical settlement pattern, rainfall, agriculture.*)
4. Three important terms associated with *spatial distribution* are used in this investigation: *pattern*, *dispersion*, and *density*. Have students define these terms in a class discussion or by using a dictionary. As an example of spatial distribution, have the students apply the new terms to the classroom setup. For example, what is the pattern of desks and chairs, and how dispersed or densely arranged are they?
9. Have students cut out each segment of the U.S. image puzzle and assemble them. Ask them to use any patterns they see in each segment to guide them in the task. Students should use clear tape to attach the segments. Once the image is assembled, have students tape a clear overhead transparency over the image to allow them to use markers to label and identify the regions discussed in the questions they are to answer.
10. Instruct students to use their assembled U.S. image to answer the questions in **Log 2**.
11. **Log 3** asks students to make inferences about human settlements from a color topographic image of an unidentified region of the world (**Figure 3**). The region is Australia and New Zealand. On this image, the students identify suitable areas of settlement based on what they learned in **Logs 1** and **2**. After students complete their speculations on **Log 3a**, distribute **Log 3b** so they can check their answers by comparing their choices with a nighttime image of Australia (**Figure 4**).

Developing the Investigation

5. The investigation is divided into three sections that build upon each other. Each section has a series of questions that students answer. Students answer the questions on their own, in small groups, or in an educator-guided class discussion. The answers are based on what students observe in the images and the maps provided. A U.S. road map is needed. A shaded relief map of the United States (**Figure 5**) will be needed.
6. Distribute and have students read the **Briefing**.
7. Distribute **Log 1**. It guides students to a basic understanding of spatial concepts associated with human settlement patterns by using an image of the northeast region of the United States. The image shows the nighttime lights in this region. Discuss the information about spatial concepts with the students to assure their understanding before proceeding with the questions.
8. Distribute and read copies of the student pages for **Log 2** of this investigation. Also distribute copies of **Figure 2: United States at night puzzle**. **Figure 6** is an assembled United States at night puzzle image to use as a guide. **Log 2** builds upon what the students learned in Log 1. It uses a different image. The students must first assemble the puzzle made from pieces of an image of the nighttime lights of the United States and then answer questions about what they observe in the assembled image. This allows them to develop a better understanding of human settlement patterns.
12. In concluding the investigation, have students develop new questions that can be asked about the image. They must also be prepared to answer their new questions.
13. Guide students into discussions of possible future settlement patterns and influences of future population growth in the United States. An example may be that cities and urban areas continue to spread out using more and more land. Future settlement patterns may be influenced by road development, development of automated, computer-controlled autos, high-speed rail travel, and information technology such as computers and other electronic devices which allow people to work away from a specific factory or office and thus avoid commuting to work.

Concluding the Investigation

Background Settlement Patterns

Why do you live where you live? Where do people choose to live? Why do they choose to live there? People have lived on Earth for thousands of years. Throughout history they have chosen particular settlement locations for many practical reasons. For just as many reasons they have packed up and moved to settle in other areas. Sometimes bloody wars have been fought over the right to settle in a particular

region. Also, natural hazards such as floods, earthquakes, and climate changes have influenced people to change the locations of their settlements. Cities, highways, roads, agricultural areas, industrial regions, and transportation hubs around the world are factors that contribute to the formation of human systems. When the United States was settled, early settlements began in the east and gradually moved westward. Could this be the reason the eastern United States is more densely populated than the west? What if the settlements began in the west and moved eastward instead? How would the United States look today?

NASA has been observing and studying Earth since 1958 with aircraft, spacecraft, satellites, and humans. These observations have generated millions of images and tremendous amounts of data. NASA Earth observations help geographers worldwide to study and answer many questions about human migration and settlement patterns. Where will human settlements be 10 years, 20 years, or even 100 years from now? Can humans build settlements on other worlds like Mars or our Moon? Will settlements of other planets become a necessity?

Nighttime Image

This map is a compilation of satellite images from the National Oceanic and Atmospheric Administration (NOAA), the National Geographical Data Center (NGDC), and the Defense Meteorological Satellite Program (DMSP) that show the continental United States at night. The image of the U.S. nighttime lights was derived from cloud-free portions of 231 orbits (October 1994 to March 1995) of DMSP Operational Linescan System (OLS) data. The majority of the detected features are lights from cities and towns. The arrangement of lights on this map is called a *spatial distribution*.

Spatial Distribution Concepts

There are three important concepts in locating items in space. They are *pattern*, *dispersion*, and *density*.

Pattern refers to the arrangement of items within a distribution in terms of density, clustering, alignment, and orientation. *Dispersion* refers to whether items are clustered or spread out. *Density* means the number of items within a defined area. Examining the distribution of lights across the United States will help students understand these three concepts.

Evaluation

Log 1

1. Night
2. Space
3. Population
4. Absence of population
5. No
6. Students should see population clusters, linear arrangements of population, and even distribution and spacing between clusters.

Log 2

1. Answers may vary.
2. They are lakes.
3. Gulf of Mexico; offshore platforms
4. Rugged, arid terrain discourages population.
5. Answers will vary.
6. Answers will vary.
7. More people live along the coast.
8. Answers will vary.
9. Answers will vary.
10. Students may see that population densities are greater in the eastern portion of the United States than in the western portion.
11. Students may see linear patterns running east-west and north-south in the west and trending southwest to northeast in the east following the Appalachians. Answers will vary.
12. Students may observe that population is least dense in the drier regions of the United States.
13. Answers will vary, but there is a relationship between population and elevation and relief.

Resources

NASA Spacelink
<http://spacelink.nasa.gov/>

NASA Earth Science Enterprise
<http://www.earth.nasa.gov/>

National Oceanic and Atmospheric Administration (NOAA)
<http://www.noaa.gov/>

National Geophysical Data Center (NGDC)
<http://www.ngdc.noaa.gov/>

Defense Meteorological Satellite Program (DMSP)
<http://www.ngdc.noaa.gov/dmsp/dmsp.html>

U.S. Geological Survey (USGS)
<http://www.usgs.gov/>



Module 2, Investigation 1: Briefing

Where do we choose to live and why?

Background

Why do you live where you live? Where do people choose to live? Why do they choose those places? People have lived on Earth for thousands of years. Throughout history they have chosen particular settlement locations for many practical reasons. For just as many reasons they have packed up and moved to settle in other areas. Sometimes bloody wars have been fought over the right to settle in a particular region. Also, natural hazards such as floods, earthquakes, and climate changes have caused people's decisions to change the locations of their settlements.

Cities, highways, roads, agricultural areas, industrial regions, and transportation hubs around the world are factors that contribute to forming human systems. When the United States was settled, early settlements began in the east and gradually moved westward. Could this be the reason the eastern United States is more densely populated than the west? How does this historical migration affect current population patterns in the United States? What if the settlements had grown in the west and moved eastward instead? How would the United States look today?

NASA has been observing and studying Earth since 1958. These observations have been made with aircraft, spacecraft, satellites, and humans on the ground. These observations have generated millions of images and tremendous amounts of data. NASA Earth observations have helped geographers worldwide study and answer many questions about human migration and settlement patterns by providing researchers with large-area views of our planet. Where will human settlements be 10 years, 20 years, or even 100 years from now? Can humans build settlements on other planets like Mars or our Moon? Will settlements of other planets become a necessity?

In this investigation, we look at one region of Earth using some unique and interesting perspectives including: images of Earth taken from space, a relief map, and a road map. Using these views we identify where human settlements are found and why these settlement patterns exist.

Objectives

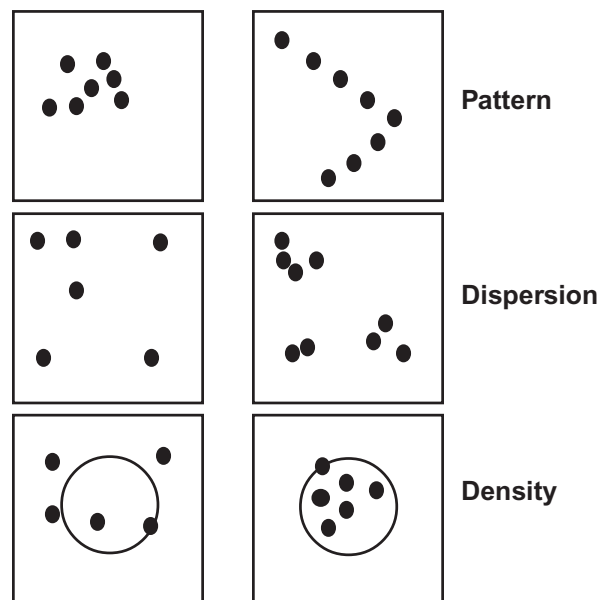
Upon completion of this investigation, you will:

- understand different ways of observing Earth,
- understand ideas of spatial distribution and how these are used to understand human settlement patterns, and
- identify human settlements and patterns using maps and images.

In this investigation, you will learn spatial distribution concepts: *pattern*, *dispersion*, and *density*. You will accomplish this using an image of an unidentified location on Earth and answering questions about what you observe in that image.

Spatial Concepts

The arrangement of things on Earth's surface is called *spatial distribution*. Observe these six sets of dots. Each square represents an equal area. Each one illustrates an important concept in the location of items in space. They are *pattern*, *dispersion*, and *density*. *Pattern* is the arrangement and design in the distribution. *Dispersion* relates to whether items are clustered or spread out. *Density* refers to the number of items or observations within a defined area.





Module 2, Investigation 1: Log 1

Where do we choose to live and why?

Directions: Apply the spatial distribution concepts to Figure 1 to answer the following questions.

Questions

1. During what time of the day was this image taken?

2. Do you think this image was taken from the ground, airplane, or space?

3. What do the areas of light on the image indicate?

4. What do the areas of dark on the image indicate?

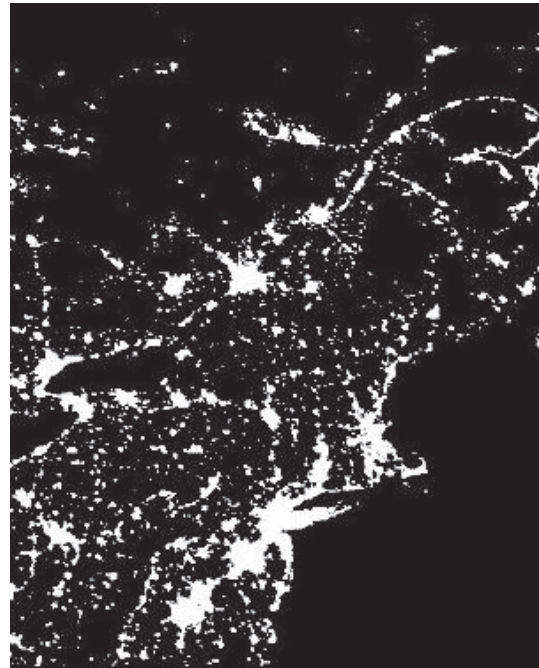
5. Are the areas of light equally dispersed?

6. Do you see any patterns? If so, identify them.

7. Use a U.S. road map or atlas to:

- identify and label specific cities, water bodies, roads, or other specific features; and
- identify which part of the United States this image represents.

Figure 1





Module 2, Investigation 1: Log 3a

Where do we choose to live and why?

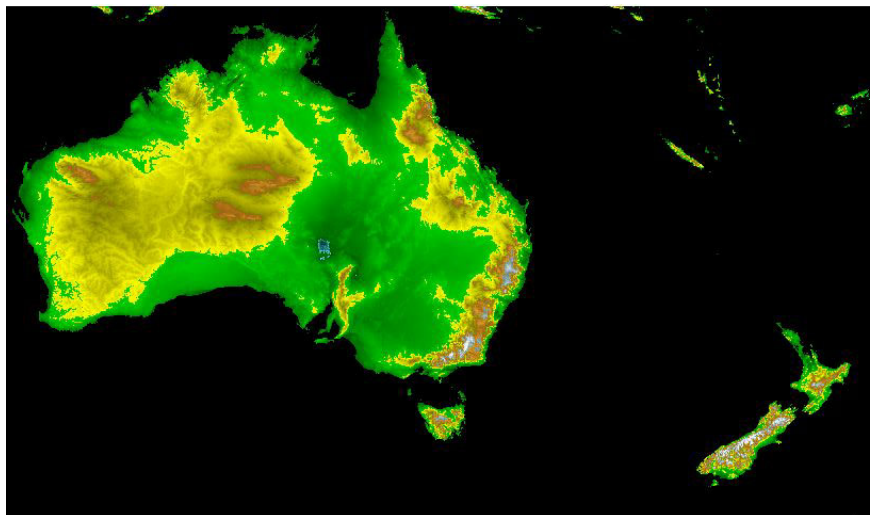
Procedures

Using the concepts you have learned so far about human settlement patterns, observe the topographic map (Figure 3) and identify locations that would best support human settlements. In the image, the different colors identify different elevations.

Figure 3: Color topographic image

Elevation Key:

Lowest	dark green
	light green
	yellow
	tan
	brown
Highest	white





Module 2, Investigation 1: Log 3b

Where do we choose to live and why?

Figure 4



1. Observe the night image (Figure 4) of the same location. Were your predictions accurate according to what you observe in the night image? Why or why not?

2. Using a world map, identify the land masses and water bodies represented in Figures 3 and 4.
